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**REGIONAL ASPECT OF TECHNOLOGICAL MODERNIZATION
OF RUSSIA: EXPERIENCE OF 1990S**

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Abstract

The regional dynamics of the Urals had repeated the Russian trends of development. By the 18th century, the Urals had all the prerequisites to become a testing ground for modernization. It had passed through three basic stages. The first stage of modernization – the protoindustrialization covered the period from the 18th century to the first half of the 19th century. The mining sector has become an important factor of the Urals modernization. The second stage - the early-industrial modernization took place in the second half of XIX - beginning of XX centuries. Throughout this period, a lot of factories and plants were built in the mining industry. Continuation of the early-industrial modernization occurred in the 1930s. It was a period of the accelerated industrialization, when the Ural has become a central link of the Ural-Kuznetsk complex. The third stage - the late-industrial modernization began in the second half of the 1950s. The technological revolution was at the heart of the late-industrial modernization. In the second half of the 1980s, there was an objective need to create a high-tech industry. But in the early 1990s, the Liberal Democrats came into power in Russia. They took the concept of transition to a postindustrial society as soon as possible. The loss of half of the industrial potential of the country was the result of this scientific and technical policy in the 1990s.

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1. Introduction

1.1. Urgency of the issue

Currently the development of science and technology is crucial for Russia as a factor of its national security. The alarming trends are observed in the scientific and technical spheres. Prestige of the profession of the scientist is constantly falling. In society, science is perceived like a useless case, which



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does not bring the practical benefits. Obviously, there is a similar perception of science among representatives of power. With the turn of the 1990s, there has been a drop in research activity. The ideas that the country can develop without relying on science, have triumphed. The main stake was made on the sale of raw materials. This was one of the components of the crisis and destruction of Russian statehood in the 1990s.

The governance system in Russia is not focused enough on the need for priority development of science and technology when choosing a strategy for the development of society and mechanisms to counter internal and external threats. Internal threats to national security arise from the negative effects of depopulation and population ageing in the near future, from a low economic competitiveness and regional differences. External threats to Russia's national security arise from the intensifying global competition for resources, including the intellectual resources, from the political and economic reorganization of the world.

Preventing these and other threats to national security cannot be accomplished in the present world without using of the new advances in science and technology.

1.2. Problem statement

A clear idea of the state of the Russia's industrial potential gives an analysis of the situation in an industry in the Urals. This region is one of the most industrialized regions of the country. During the 1990s, the structure of industry of the Urals has changed. The share of the fuel and energy sector has increased from 12 to 30 per cent, while the share of mechanical engineering has decreased from 32 to 17 per cent. The light industry is almost completely lost its position. The share of the forest complex has declined by more than 1.5 times. Mechanical engineering as the basis of development of industry and other economic sectors in the Urals began to lose its leading position. By 2000, the structure of industries in various oblasts of the Urals was linked mainly to the primary processing of raw materials. Reducing the volume of industrial production was proof of the deindustrialization of the region. The greatest losses in the Urals took place in the economy of Kurgan oblast. By the beginning of 2000, no more than 1/3 of the industrial facilities continued to operate in comparison with 1990. Less than 40 per cent of industrial production was produced in Sverdlovsk oblast and the Udmurt Republic in 2000 relative to 1990 (Kharitonova, & Laktionova, 2003).

Severe destruction occurred in the scientific and technical sphere. In the Soviet Union, 68 per cent of companies developed research and utilized its results in 1990. Severe destruction occurred in the scientific and technical sphere. In the Soviet Union, 68 per cent of the engineering companies carried out scientific research in 1990. In Russia, the number of these companies decreased to 3.7 per cent in 1998. In the USA, Japan, Germany and France, scientific researches were carried out in 70-80 per cent of companies. The monetary valuation of the losses of Russia's scientific potential amounted to more than \$60 billion in the 1990s. It was 15 times more than the annual domestic spending on the development of science in the Russian Federation (Makarov, & Varshavsky, 2001).

The consequence of the destruction of the industrial and scientific and technological potential was the emergence of an internal threat to the country's sustainable development. As a result the problem of national security has become very pressing. The national security represents a state of defending the

country from both internal and external threats. An integral component of national security is a scientific and technological security. Its goal is the preservation and reproduction of a scientific potential.

Achieving this goal requires fulfilling the following tasks related to the provision of scientific and technological safety of the state: a) the reproduction of national scientific, technical, technological and industrial potentials; b) development of priority directions of scientific research and technological development to ensure the competitiveness of the national economy; c) ensuring of secrecy and protection facilities of the strategic importance and enterprises whose work is the subject of State secrets; d) export control over the spread of technologies and scientific developments; e) protection of intellectual property rights in the fields of foreign trade and scientific-technical cooperation; f) intelligence activities in the field of technologies and scientific developments of strategic importance.

In accordance with the above-mentioned tasks, it is clear that one of the most important components of the research of scientific and technological safety is the analysis of the scientific potential. In addition, the influence of such phenomenon of scientific and technological progress as its regionalization led to the need to study problems of scientific and technological safety not only of the country in its entirety but also in certain regions, and, above all, in the old industrial regions which include the Urals (Lebedev, 2008).

2. Materials and methods

2.1. Methodological “tools” of the research

The modernization theory is used as a methodological basis of this paper. Its methodological “toolbox” allows us to provide the most adequate explanation of the socio-historical process. The transition from the traditional, agrarian society to the industrialized, modern society is the main direction of the modernization process. The modern society is based on the knowledge economy. Therefore, the most important feature of the modernization is the creation of innovative systems based on the development of science, engineering and technology. The essential characteristics of the modernization process strongly manifested themselves in the XX century, particularly at the stage of the late-industrial modernization, when there was a radical transformation of the labor process based on its scientific organization. Information and knowledge had emerged as strategic factors in economic and social progress (Artemov, 2006).

Russia accepted this way also. However, the country differed considerably by its history, its socio-cultural foundation, and its geographical location. Russia does not belong to the group of countries which are the “pioneers” of modernization. In the West, modernization has paved the way as a result of its internal development. The Russian society was forced to modernize itself under the influence of external calls and threats. This model of development was a response, above all, on the geopolitical threat. Essentially, Russia has belonged to the group of countries with catching-up economies and its modernization was based on the active borrowing of new technologies, cultural values of the leading countries of the world. But these innovations had been accepted with difficulty because of exceptional scale of the territory, of regional differences. The innovations were imposed by force. The state was the most active and strong element of the Russian society structure. It has solved problems of modernization. But in so doing, it has relied heavily on the methods of extra-economic coercion (Alekseev, 2014). As a

result, the gradual centralization and bureaucratization of the social and economic processes had taken place.

The dominant role of the State in the process of modernization was especially evident in the Soviet period of Russian history. In the post-Soviet period, at the turn of the 1990s, there was a need to ensure a rational combination of vertical (federal) and horizontal (regional) structures. Organization of self-developing socio-economic regions, the creation of the economic environment for their development without artificial stimulants of the economic and political center were necessary for the action of such phenomenon of modern scientific and technological progress as its regionalization.

2.2. Ideas used while creating the paper

In this paper, we propose one of the versions of the modernization theory, which can be defined as the spatially-oriented version. The essence of this version is reduced to the following provisions.

The regionalization - the spatial development aimed at the implementation of certain types of economic activities in the different regions is an essential aspect of the modernization. The spatially oriented method of the research allows us to go beyond the boundaries of macro analytical schemes and to interpret the large-scale social processes by aggregating of local events.

The processes of modernization and the regional development go together and interact with each other (Alekseev, 2004). The modernization helps to equalize the levels of development of certain regions, the universalization of their technological, socio-cultural structures. On the other hand, the elimination of regional differences is the essence of the modernization projects. The modern processes of the regionalization were a reaction to the universalization of life caused by the modernization. In the mid-1980s, the concept of sustainable development has been elaborated. It was a response to the side effects of modernization, globalization of economic and technological processes. The core of this concept lay in the redistribution of the roles between the different regions.

The process of modernization takes place on the basis of the defined spatial coordinates. These coordinates determine its capabilities and limitation. The transition from the traditional, agrarian society to the modern society depends not only on the basic logic of the modernization process (rationalization, mobilization, structural differentiation, etc.), but also on the place of its action. The general and specific characteristics of the modernization process can be explained adequately and fully only on the basis of studies of complex problems, which related to their spatial development.

In addition, there is an ambivalent relationship between the tradition and the modernization. The tradition acts as a positive catalyst and an obstacle for modernization at the same time. The tradition can both weaken and strengthen itself in the process of modernizing. On the one hand, the tradition can play a positive role in the modernization. The constructive role of tradition can be manifested both at the country level (the great tradition) and regional level (the small tradition). These traditions can be transformed as a result of their adaptation to new challenges and changing conditions. On the other hand, the great tradition and the small tradition may pose a threat to national security (Poberezhnikov, 2006).

We recognize also the important role of diffusion (diffusion of innovation) as a significant factor of the modernization and the acceleration of the economic growth. There is a variation of the diffusion effects of the same element or a set of elements for different regions.

3. Results of research and discussion

By the early 1990s, the Urals region was composed of the Republic of Bashkortostan, the Udmurt Republic, Kurgan, Orenburg, Perm, Sverdlovsk and Chelyabinsk oblasts. In this regions, the expanding threat to scientific and technological security has occurred very fast. By the end of the 1990s, the Urals region was in a state of deepening crisis. Social, economic and political processes, occurring in the country in the 1990s, have led to a significant decline in the Urals region basic indicators of the scientific and technological development. These included training of researchers, diffusion of innovation, financing of science and other indicators.

First of all, the share of researchers employed in industrial enterprises decreased significantly. Three of the seven regions of the Urals - the Republic of Bashkortostan, Orenburg and Sverdlovsk oblasts — were at a critical stage of the crisis by this indicator. In 1998, the indicated rates made up 25.3, 25.69 and 57.28 of researchers per 10,000 populations, respectively. These regions had 42, 69 and 36 seats among the 80 Russian regions surveyed. The main reason for this situation was a sharp drop in demand for research and development on the part of industrial enterprises in the 1990s.

The situation was worse by the indicator of the number of highly qualified specialists, including Doctors of Science and Candidates of Science per 10,000 populations. Two Ural regions of Russia - Perms and Chelyabinsk oblasts — were in a critical phase of the crisis, four regions - the Republic of Bashkortostan, Kurgan, Orenburg and Sverdlovsk oblasts — were at a threatening stage of the crisis by the pointed out indicator. In the late 1990s, these regions had 48, 60, 41, 57, 62 and 42 seats, respectively, by the indicator of the number of highly qualified specialists among the 80 Russian regions, in which the assessment of scientific and technological security was held.

The situation was unfavourable also in terms of training of researchers. The regions of the Urals belonged to that half of the Russian regions, which were in a state of crisis by the indicator of the number of postgraduate students and doctoral students per 10,000 people. The regions of the Urals occupied the following seats among the Russian regions: Kurgan oblast - 66; Chelyabinsk oblast - 56; Sverdlovsk oblast - 49; Orenburg oblast – 48 (Tatarkin, Lvov, & Kuklin, 2000).

In the 1990s, some of the trends in the training of researchers in the Urals were revealed. The number of postgraduate students enrolled in daytime courses increased, principally owing to the decline number of postgraduate students enrolled in distance education courses.

The age structure was characterized by a much higher proportion of postgraduate students at young ages - less than 26 years old. They have accounted for 72 per cent of the total number of postgraduate students. The postgraduate students over 30 years old have accounted for 14 per cent. The men have predominated among postgraduate enrolled in daytime courses and in distance education courses. In the 1990s, there was a significant outflow of highly qualified specialists directed to commercial organizations and foreign research centres. At the same time, there was a decline in the prestige of scientific work (Gorshkov, 2002).

The efficiency of industrial production was directly dependent on the level of scientific and technical support. The situation was dire in terms of dissemination of innovations at the Ural enterprises. In the late 1990s, all regions except Kurgan region were at the stage of crisis by such an indicator as the share of innovative products in the total industrial output. The regions of the Urals had quite low ranks by this

indicator among the 80 Russian regions surveyed. Orenburg, Chelyabinsk region and the Udmurt Republic were at 55, 54 and 49 places respectively. The main reason for this situation was the absence of domestic innovative technologies. The financial capacities of the regions for the production of innovative products were the weakest.

However, the trend of deindustrialization was not the only development trend. There was a tradition of development of the Urals as a “polygon” of scientific and technical progress. This tradition was started in the preceding period and manifested itself in the fact that the Urals retained the features of the past and contemporary, which coexisted together. Traditional production was focused on large enterprises, and therefore was in need of centralized management. The robotic technology, flexible production lines, electronic computation systems could be effectively used on a modern small enterprises. This determined a tendency to dispersion of production. The tendency to dispersion of production was the cause of decentralization of management of the scientific and technical progress. Economic power began to grow in the regions.

There was another tradition which had influenced the development of science and technology in the Urals in the 1990s. The territorial division of labour in the production was accompanied by territorial division of labour in the field of scientific activity. There had been a trend towards the geographical dispersion of the scientific and technical potential.

This trend manifested itself in the process of institutionalization of science in the region. A broad life-support system of science was created. The network of applied research institutions and plants laboratories was formed. The scientific research in the regions was coordinated by the Ural branch of the Russian Academy of Sciences. More than 400 Doctors of Sciences and 1500 Candidates of Sciences were employed in 37 institutions of the Ural Branch of Russian Academy of Sciences; more than 1770 Doctors of Sciences and 5040 Candidates of Science worked in the higher education institutions (Lebedev, 2005). In particular, in the early 2000s more than seven per cent of all Russian researchers were employed in the research units of the Urals. The region's share in all Russian domestic expenditure on research and development was more than eight per cent.

A positive development was the increase of prestige of higher education and the growth of inflows of young people into higher education institutions in the 1990s. The results of calculations of scientists of the Institute of Economics of the Ural branch of the Russian Academy of Sciences showed that all regions of the Urals were in a satisfactory situation by the indicator of the number of university students per 10,000 populations.

In addition, the scientific and technological progress has become an independent object of social regulation in the preceding period. The structures of territorial management of the development of science and technology began to be formed. In particular, the Centers of Standardization and Metrology, the Centers of scientific and technical information, the interdepartmental Council on coordination of research in the Ural branch of the Russian Academy of Sciences, the Councils of Rectors and the Councils of Directors of industrial enterprises were formed. These structures were effective forms of territorial organization of scientific and technical progress. The institutionalization of territorial subjects of management was a manifestation of the action of such phenomenon of modern scientific and technological progress as its regionalization. This phenomenon is one of the essential characteristics of economic development in the period of the late-industrial modernization.

4. Conclusions

The processes of modernization and the regional development go together and interact with each other. The regional development and the regional policy are important tools for expanding the range of possibilities of the society and accessing new resources. In the industrial and especially in the post-industrial societies, there is such phenomenon of the modern scientific and technological progress as its regionalization. It has contributed to the acceleration of the process of the development of science as a productive and social force in the period of the late-industrial modernization.

However, the modernization could change its trajectory if there was a slowdown in the technological progress. The trend towards the deindustrialization of Russia was manifested in the 1990s. The country has lost half of its industrial capacity. The deindustrialization has caused a threat to scientific and technological security in the Russian regions.

When finding positive and negative outcomes of the modernization of one of the Russian regions - the Urals — in the 1990s, we can make the following conclusions. Firstly, a slowdown in technological progress has coincided with the period of deceleration in the growth of Russia's economy. This has contributed to deindustrialization of the country. Such coincidence was not accidental. It was indicative of a stable connection of scientific, technical and socio-economic progress.

Secondly, the experience of modernization of the Urals confirms the conceptual ideas that economic progress in modern conditions is not associated with episodic achievements of experimental science. It is based on the development of fundamental knowledge.

Thirdly, the stagnation of the science and technology activities of the 1990s was caused at first the decrease of the effectiveness of the Soviet social and political system. Then in the early 1990s, the Liberal Democrats came into power in Russia. They took the concept of transition to a post-industrial society as soon as possible. But this experiment failed. Fourthly, the transition to market relations does not automatically provide a high rate of technological progress. The centrally planned economy was not also the determining factor in the promotion of technological innovation and scientific advancement. These judgments can clarify the reasons for the successes and the failures of the modernization of the Russian society in the 1990s.

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